



LONG-RANGE TRANSPORTATION PLAN - HORIZON 2050 EXECUTIVE SUMMARY

The Conseil Général des Ponts et Chaussées (CGPC) is often called upon to advise the French government on major policy decisions affecting transportation systems. Following the 2002-2003 audit carried out on the nation's largest infrastructure projects, it was deemed essential to chart a long-range strategic plan to 2050, a time horizon adapted to policy decisions in this field (15 to 20 years) and to the even longer-term horizon over which infrastructure facilities get depreciated (30 years). Launched in the fall of 2003, this planning exercise has involved, alongside members of the CGPC senior policy development group, a number of experts in the areas of demographics, economics, transportation, energy and tourism, including representatives from the Ministry's Research and Scientific Affairs Office (DRAST), the Secretariat General's Strategic Development mission, and the Directorate on International and Economic Affairs (DAEI), the civil aviation authority (DGAC) and the INRETS Transport Research Institute.

Focused exclusively on transportation flows within France, this document is not meant to describe possible future states of the transportation system in the year 2050; instead, it is intended as a discussion document, a starting point for pursuing a common vision on key long-term challenges. We present herein a synthesis of findings from the four major steps constituting our approach: a retrospective of historical trends in French transportation, exploratory scenarios out to 2050, an initial set of insights on future flows, and relevant public policy considerations.

1. BUILDING ON A RETROSPECTIVE OF HISTORICAL TRENDS

In drawing lessons from evolution over the last three to five decades, this review has identified key drivers of change for the French transportation sector. Five fundamental forces have spurred **growth in both passenger and freight transportation** over this period: increased wealth generation, the dismantling of economic borders, lifestyle changes (increased automobile ownership, preference for single-family neighborhoods, greater leisure time...), the availability of low-cost energy in abundant supply, and the development of high-speed transportation systems (urban expressways, suburban rapid transit, interurban motorways, the TGV rail network, airplane travel). The consequences of this expansion in traffic, which in large part favored road transportation, were significant in terms of **transportation-based energy consumption**, which quintupled over this time frame. In 2002, transportation also accounted for 27% of the nation's greenhouse gas emissions.

FACTS AND FIGURES ON TRANSPORTATION TRENDS

Freight transportation: Evolution tied to economic prosperity

- Since 1970, the travel distance of each ton of freight has been rising faster than GDP.
- Since 1992, road transit has been increasing at a 5% average annual rate.

Passenger transportation: Income-related effects and automobile ownership

- The rate of automobile ownership among households increased tenfold between 1955 and 2003.
- In 1994, daily travel in France averaged 35.5 km per capita vs. 16.3 km in 1973.
- Between 1986 and 2004, the international share of all air traffic flows in metropolitan France rose from 62% to 74%.

The construction of high-speed transportation networks

- Between 1960 and 2005, over 10,000 km of motorways and 1,500 km of high-speed railway (TGV) were built in France, along with Paris' Orly and Roissy-Charles-de-Gaulle airports plus eight major regional airports.

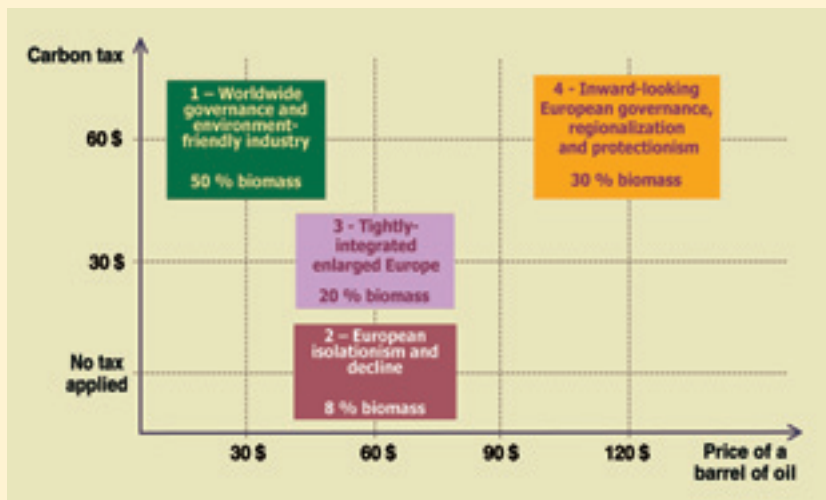


2. FOUR SCENARIOS TO EXPLORE POSSIBLE FUTURES

The focus of this prospective approach entailed devising four exploratory scenarios extending to 2050. For each one, we modeled applicable trends relative to transportation patterns (passengers and freight), as well as energy consumption and CO₂ emissions. The four scenarios were based on **four contrasted views of the geopolitical context**, shaped by worldwide and European governance on environmental and climate issues and by economic openings and trade specialization:

- Scenario 1 - "Worldwide governance and environment-friendly industry": progress in worldwide environmental governance, coupled with effective European governance and a very open global economic system;
- Scenario 2 - "European isolationism and decline": no effective scheme of environmental governance, neither worldwide nor European, and a more protectionist stance;
- Scenario 3 - "A Tightly-integrated, enlarged Europe": lack of governance worldwide on global issues such as environment and climate shifts, with further progress on European integration and enlargement throughout the Mediterranean Basin and Russia, as well as an expanding economic and trade outlook;
- Scenario 4 - "Inward-looking European governance, regionalization and protectionism".

ENERGY-RELATED HYPOTHESES FOR EACH SCENARIO



The hypothesis selected to highlight energy alternatives consists of introducing the rechargeable hybrid vehicle along with ligneous biomass. Biomass may supply up to 50% of all liquid fuels required in 2050 for the transportation sector (Scenario 1), which would imply allocating 80,000 to 100,000 km² of the 230,000 km² of unfarmed land (forestland, moorland, prairies) available throughout France.

All these scenarios incorporate a **series of demographic and economic assumptions** (with a French population ranging from 59 to 70 million and GDP growth of 1-2%), along with **assumptions on energy prices** and the adoption of **carbon and petroleum taxes**: see exhibit below.

The four scenarios incorporate common assumptions: no mobility rationing, stability of speeds across transportation modes, no consideration paid to infrastructure bottlenecks. They all emphasize key structural trends (and trend inflections), yet for the most part exclude potential crises and system failures. Some failures have been assessed with respect to energy and the greenhouse effect, demographics and economics, behavioral changes, transportation safety-security) and should be addressed in more detailed subsequent analyses with a scope not limited to transportation.



3. INSIGHTS ON TRANSPORTATION FLOWS

The modeling of these scenarios and their underlying assumptions has yielded order-of-magnitude estimates of changes to be expected over the next 50 years. The four scenarios all reveal **moderation in the growth of transportation flows**.

The general tendency favoring lower growth in passenger mobility is particularly striking over shorter distances (0-50 km). This slowdown, representing perhaps one of the most significant breaks with the past 50 years, may be explained by various factors: a cooling in the rise of household incomes (from +2.1%/year to +1.3%/year) against a backdrop of increasing transportation costs (due to stricter environmental protection and safety rules, rising fuel costs); a flattening in household automobile ownership rates; a cap on the "budget-time" devoted to transportation uses; and stability or decline in average transportation speeds in response to constraints from systems operations, safety or environmental concerns.

On the other hand, gains in passenger mobility are more substantial (except in Scenario 2) for medium and longer distances (between 50 and 1,000 km) and favor the automobile and high-speed train modes. The growth in passenger air travel (+2.2%/year) will be spurred by international flows, yet this pace will also slow compared with the period 1986-2004 (+4.3%/year).

The expansion in freight flows will consequently drop, while remaining heavily tied to international trade patterns, thereby inciting (except for Scenario 2) greater traffic concentration both around ports and on major transit corridors.

Two important lessons drawn from these trends:

- The potential exists to develop non-automobile modes that consume less greenhouse gases, especially in large metropolitan areas, on high-density freight corridors thanks to high-speed network extensions and available connections. Yet, this alternative potential will only apply to a portion of all trips and, as such, **the road will remain the predominant mode of transportation through 2050. It is thus critical to improve energy efficiency and reduce greenhouse gas emissions from road transportation sources;**

- **A reduction, by a factor of around 2.5, in greenhouse gas emissions from transportation sources does seem feasible**, even despite this dominance of roads in the overall transportation supply. This improvement is highlighted in Scenario 1, which proves to be the boldest from an energy perspective: it projects **more economically-efficient vehicles** (consuming 3 liters/100 km) **and lesser dependence on oil-based fuels** (with resources being split into equal thirds between biomass, electrical power from nuclear or CO₂ sequestration and oil/petroleum).

4. CRITICAL PUBLIC POLICY ISSUES AND CHALLENGES

This assessment is intended as a contribution to developing strategic approaches and as a framework for building public-sector action plans.

The first of these objectives implies **preparing for the "post-oil" era along with a serious effort to cap or reduce greenhouse emissions**, global challenges that France or even Europe acting on its own can only influence to a limited extent. Yet Europe could act as the driving force in forging a worldwide consensus to meet these challenges cooperatively. The recommendations listed here are of three types:

- assign clear **priority to Research & Development activities**. In this field, developing policies on a European rather than national scale is more promising. The specific fields targeted straight away would include: rechargeable hybrid vehicles, carbon-free electricity production and synthetic fuels stemming from biomass;
- initiate **more vigorous standards-setting actions**. One of the keys to European policy should focus on regulatory measures (adopting energy standards on private / commercial vehicles and fuels, taxes, licensing). These steps would be intended to foster the large-scale design and dissemination of high-performance technologies for both energy consumption and greenhouse gas emissions;
- support **the emergence and development of new energies** through economic and regulatory tools at the global, or at least European, level; these would be aimed at the greenhouse effect, e.g. negotiable emission licenses or a carbon tax on all carbon released by fossil fuels.

The second objective recommends **a more specific handling of network bottlenecks**. While over horizon 2050, congestion risks continue to be contained, the adverse effects of traffic concentration will be felt: within large urban areas, along the Rhone Valley corridor and the Atlantic seaboard, on high-speed lines spanning from the Paris Region, Paris' two main airports and the ports of Marseille and Le Havre. This appears to be an opportune time to undertake, in conjunction with the large-scale infrastructure projects approved by the government in 2003, more focused studies and measurements over these particular zones.

As a third impetus, it would be necessary for the Ministry of Transportation to pursue and enhance this venture, to strengthen strategic monitoring and research on topics not yet fully explored, such as future technologies, an analysis of mobility trend factors for passenger and freight flows, tourism travel patterns, and transportation system security/safety.

THE FOUR FUNDAMENTAL INSIGHTS INTO THIS APPROACH:

- **Mobility gains will be tempered.**
- **The inevitable development of alternative modes will not supplant automobile domination.**
- **One critical priority has become clear: developing research and consolidating standards in order to generate further savings and promote alternative energies.**
- **One condition appears vital: initiating worldwide negotiations (spurred by European initiative) to regulate CO₂ emissions.**

An action plan now needs to be laid out: rally backing for and solidify a shared vision of the future of transportation within the Ministry and among partners, with a fivefold purpose:

- craft an outlook for the primary transportation sectors;
- mitigate the main sources of bottlenecks;
- locate activities throughout the national territory;
- manage changes in lifestyles and production/distribution channels;
- handle potential crisis situations, especially in the area of energy supply.